Measuring Corporate Environmental Performance: The Trade-Offs of Sustainability Ratings

Magali A . Delmas

Social and Environmental Accountability Journal

Business Strategy and the Environment
Bus. Strat. Env. **19**, 245–260 (2010)
Published online in Wiley InterScience
(www.interscience.wiley.com) **DOI**: 10.1002/bse.676

Measuring Corporate Environmental Performance: the Trade-Offs of Sustainability Ratings

Magali Delmas[1]* and Vered Doctori Blass[2]
[1] *University of California, Los Angeles, USA*
[2] *University of California, Santa Barbara, USA*

ABSTRACT
Socially responsible investing (SRI) represents an investment process that reflects environmental and social preferences. The financial industry is in a unique position to move corporations towards corporate sustainability. However, there is often little transparency regarding the metrics used to evaluate corporate social and environmental performance and the trade-offs involved in the evaluation. In this paper we discuss the various trade-offs of sustainability screening methodologies. We show that the rating of companies varies significantly according to whether the screening is based on toxic releases and regulatory compliance or on the quality of environmental policy and disclosure. We base our analysis on the evaluation of the performance of 15 firms in the chemical sector. The analysis indicates that firms that have the most advanced reporting and environmental management practices tend also to have higher levels of toxic releases and lower environmental compliance. We provide methodological recommendations to help stakeholders evaluate corporate environmental performance. Copyright © 2010 John Wiley & Sons, Ltd and ERP Environment.

Received 30 September 2008; revised 14 December 2009; accepted 14 December 2009
Keywords: environmental performance; socially responsible investing; Toxic Release Inventory

Introduction

SOCIALLY RESPONSIBLE INVESTING (SRI) REPRESENTS AN INVESTMENT PROCESS THAT USES SCREENS BASED ON environmental and social preferences to select or avoid investing in companies (Renneboog *et al.*, 2008). Many investment research companies have screening methodologies to help socially responsible investors select companies. Examples of these companies include KLD Research & Analytics, Inc., based in Boston in the US, and the Sustainable Asset Management (SAM) Group, based in Zurich in Switzerland. Each of these companies has developed its own research and screening methodology for including companies in its social responsibility indexes. More recently, some environmental non-governmental organizations (NGOs) have also started to screen companies based on their environmental performance and to propose their own SRI funds. For example, the Sierra Club Fund invests in socially and environmentally progressive US companies as determined by 20 environmental and social screens.[1]

* Correspondence to: Magali Delmas, Institute of the Environment and Anderson School of Management, La Kretz Hall, University of California, Los Angeles, CA 90095-1496, USA. E-mail: delmas@ucla.edu
[1] http://www.sierraclubfunds.com/ [1 March 2009].

The financial sector is in a unique position to move corporations towards corporate sustainability (Levine and Chatterji, 2006; O'Rourke, 2003). This is because socially responsible firms included in these screens might be in a better position to attract capital. It is estimated that almost 11 percent of the assets under professional management in the United States are invested with social responsibility in mind (Social Investment Forum, 2007).[2] This amounts to $2.71 trillion in total assets under management using one or more of the three core socially responsible investing strategies: screening, shareholder advocacy and community investing. In the past two years, social investing has enjoyed healthy growth, having increased from $2.29 trillion in 2005 (Social Investment Forum, 2007). As SRI indexes become more prevalent, firms might compete to be part of such indexes by improving their environmental and social performance.

At the core of socially responsible investing is a fundamental question: can good environmental performance be associated with good financial performance? While there is an important literature analyzing the link between environmental and financial performance, there is still uncertainty about the significance of the relationship (Dowell *et al.*, 2000; King and Lenox, 2001; Konar and Cohen, 2001; Margolis and Walsh, 2003; Orlitzky *et al.*, 2003; Russo and Fouts, 1997; Waddock and Graves, 1997). Some have argued that these mixed results might be partly due to the difficulty of measuring environmental performance and to important differences among screening methodologies (Griffin and Mahon, 1997).

Although a growing number of investors are using SRI screening, the methodologies used to evaluate and screen corporations are not yet standardized and are often kept confidential by the rating organizations. While financial performance indicators are well defined and very structured (for instance return on assets and return on investment), environmental performance indicators are quite heterogeneous. This creates a situation in which the results of the screening differ widely based on the methodology used (Levine and Chatterji, 2006; Chatterji and Levine, 2008; O'Rourke, 2003). Because of the use of different metrics, investors might have little confidence in basing investment decisions on SRI screens. Metrics that are not comparable could actually lead to outcomes that harm corporate social performance (Levine and Chatterji, 2006). Furthermore, corporate managers might be confused on how to prioritize their investments in environmental improvements in order to improve the reputation of their firm with investors.

Most importantly, there might be some trade-offs between the different metrics chosen. For example, some investors might decide to reward firms that are investing today in new environmental management practices but are still major polluters. Others might prefer to invest in companies that currently have a lower impact on the environment. A recognition of these trade-offs could help increase stakeholders' confidence in SRI.

In this paper, we focus on the environmental dimension of social responsibility and evaluate various criteria to compare firms' environmental performance and management practices. We present a case study based on the analysis of the environmental performance of 15 publicly traded companies in the chemical sector. This industry was chosen because of the salience of environmental concerns in the chemical industry (Christmann, 2000; Delmas and Montiel, 2008; Hoffman, 1999). Our results show how the rating of firms' environmental performance varies according to the indicators used; we also demonstrate the trade-offs associated with different approaches.

This paper is organized as follows. First, we describe the main metrics used to measure corporate environmental performance and the trade-offs involved in sustainability rating. Second, we evaluate the performance of 15 chemical firms, based on their toxic releases, regulatory compliance and disclosure of environmental performance, as a case study to illustrate our argumentation. Third, we provide recommendations to improve screening methodologies and overcome such trade-offs.

Measuring Environmental Performance

Corporate environmental performance indicators are usually divided into three main categories: (1) environmental impact (toxicity, emissions, energy use etc.); (2) regulatory compliance (non-compliance status, violation fees,

[2] 11 percent of the $25.1 trillion in total assets under management tracked in *Nelson Information's Directory of Investment Managers* (Social Investment Forum, 2007).

DOI: 10.1002/bse

number of audits etc.) and (3) organizational processes (environmental accounting, audits, reporting, environmental management system etc.) (Ilinitch *et al.*, 1998; Lober, 1996; Wood, 1991). Screening and investment firms use different mixes of the above categories. For example, SAM focuses on eco-efficiency and environmental reporting along with industry-specific criteria.[3] KLD Research & Analytics, Inc. analyzes and selects firms based on *strengths* and *concerns* in the following categories: products and services (beneficial products and services, ozone-depleting chemicals, agricultural chemicals); operations and management (pollution prevention, recycling, management systems, hazardous waste, regulatory problems, substantial emissions) and climate change (clean energy, revenues from coal oil and derivative products) (Waddock and Graves, 1997).

Socially responsible investors might have different objectives. For some investors, evaluating corporate environmental performance is another way of evaluating financial performance. For example, Innovest, now part of the Riskmetrics group, specializes in analyzing 'companies' performance on environmental, social, and strategic governance issues, with a particular focus on their impact on competitiveness, profitability, and share price performance. By assessing differentials typically not identified by traditional securities analysis, Innovest's ratings uncover hidden risks and value potential for investors'.[4] In this case, corporate environmental performance is a proxy for good management. For other investors, the objective is to screen risky investments by filtering out companies or entire sectors that are exposed to environmental risks. For example, the Sierra Club Mutual Fund screens out fossil fuel generation because of its impact on climate change.[5] Because of these different objectives, the same firm might be rated very differently by different investors.

As we argue in this article, there are trade-offs associated with the choices of metrics and methodology used in SRI. We describe below the main trade-offs involved in measuring and evaluating corporate environmental performance.

Trade-Offs Between Positive and Negative Screenings

Sustainable investors can use negative or positive screening methodologies. Negative screening, also called 'exclusionary screening', relates to the exclusion of companies that do not perform well on some indicators or do belong to sectors that might be perceived as having a relatively high impact on the environment. Positive screening seeks to identify companies that are the best performers on some indicators. For example SAM, through the Dow Jones Sustainability Index, screens companies that are the best in class in their sector on several criteria related to corporate social responsibility. Negative screenings have been initially favored because it is often easier to agree on what constitutes a problem than to agree on what constitutes excellence. Indeed, publicly traded corporations are often complex and diversified entities and there is always the possibility that a company that excels on many indicators also performs poorly on a few indicators that might not be apparent at first. In other words, there is always room for criticism. However, negative screening does not identify best-in-class companies that might also perform well financially. The trade-off is therefore between focusing on penalizing corporations based on poor performance and rewarding corporations based on good performance.

Trade-Offs Between Environmental and Corporate Performance Criteria

How to compare progress on one environmental performance criterion with poor records on another criterion is an important challenge. For example, should investors value progress on greenhouse gas emissions to the detriment of toxic releases? The management of some environmental problems might have more direct impact on the firm's bottom line than others. For example, investors might rate more positively firms that manage their greenhouse gas (GHG) emissions well, because of the potential for regulations in that area that will directly impact firms' operations. Furthermore, energy efficiency measures might not only reduce GHGs and the exposure of the firm to GHG regulations but also relate directly to the firm's efficiency by reducing costs (Klassen and McLaughlin, 1996; Porter and van der Linde, 1995; Reinhardt, 1999). However, in some cases the main impact of such a

[3] http://www.sam-group.com/htmle/research/methodology/steps/analysis.cfm [26 October 2009].
[4] http://www.innovestgroup.com/ [1 September 2008].
[5] http://www.businesswire.com/portal/site/google/?ndmViewId=news_view&newsId=20060418005927&newsLang=en [1 March 2009].

DOI: 10.1002/bse

firm might be on biodiversity, water consumption or waste generated. The trade-off in this case is to favor environmental issues that might have a more direct and immediate impact on firms' operations and performance over those that might be less directly related to a firm's operations but could potentially have a bigger environmental impact.

Trade-Offs Between Past, Current and Future Performance

While most sustainability ratings strive to assess corporate environmental performance, some might choose to focus on past or current measured performance while others put the emphasis on the potential to improve future performance based on current management practices. For example, SAM claims that its rating methodology is performance oriented: 'While recognizing that approaches to managing certain sustainability issues and challenges vary depending on the maturity of the issue, SAM Research constantly aims to evaluate and identify performance rather than the mere existence of policies and systems designed to address particular sustainability issues – real commitment is demonstrated by performance'.[6] However, information about actual environmental performance is often difficult to obtain, and often indicators of organizational practices or policies are used as proxies for output measures. Indicators of organizational practice measures have also the advantage of representing the potential for improvement. They indicate the efforts of a company attempting to mitigate its environmental impacts. They might therefore be used by some socially responsible investors as a way to predict future corporate environmental performance. The trade-off here is to focus on management and reporting practices as a proxy for future performance at the expense of looking at current performance.

Trade-Offs Between What Can Be Measured and What Should Be Measured

Measuring environmental performance faces an important challenge: there is scant data available to compare firms. Because the Toxic Release Inventory (TRI) published by the US Environmental Protection Agency (EPA) is one of few publicly available sources of comparable data on environmental performance in the US, it has been used as the main impact measurement indicator in academic studies (Chatterji *et al.*, 2009; Ilinitch *et al.*, 1998; Gerde and Logsdon, 2001; King and Lenox, 2001; Terlaak and King, 2006). Because of this lack of publicly available data, socially responsible investors have been complementing TRI information with an analysis of corporations' environmental reports or have been asking corporations directly about their environmental management practices and performance through survey questionnaires. However, information provided in environmental reports is rarely comparable across firms. Furthermore, firms might be unwilling to respond to survey questionnaires, because of survey fatigue or because they are reluctant to reveal information regarding their environmental emissions (Levine and Chatterji, 2006). There is always the risk that the choice of indicators might be dictated by the availability of the data and/or that differences in ratings might be attributable to measurement errors (Chatterji and Levine, 2008). The trade-off is between the ability to compare a higher number of firms with publicly available databases that might not always be the most relevant, and using more detailed and important data that is possible to obtain for only a smaller subset of these firms. Furthermore, there is an apparent trade-off in the resources one might invest in order to collect additional data, and the contribution of such data to the overall ranking.

In conclusion, environmentally conscious investors might have multiple motives and face multiple trade-offs when choosing environmental metrics to evaluate corporate environmental performance. We describe below the main trade-offs involved in rating corporate environmental performance using the case of 15 chemical companies.

Case Study

In order to open the 'black box' of sustainability ratings, we present a case study based on the detailed analysis of the environmental performance of 15 firms in the chemical sector. Firms were chosen based on the following

[6] http://www.sam-group.com/htmle/research/philosophy.cfm [17 September 2008].

DOI: 10.1002/bse

Firm	Headquarter location	US sales[a] (millions)	Total sales (millions)	SIC code 3 digits	SIC code description
Avon Products, Inc.	New York, NY	2 141	8 150	284	Soap cleaner and toilet goods sector
Clorox Company	Oakland, CA	3 800	4 388	284	
Colgate-Palmolive Company	New York, NY	2 507	11 397	284	
Dial	Germany (Henkel)	N/A	N/A		
Dow Chemical Company	Midland, MI	17 597	46 307	282	Plastics materials, synthetic resins, and synthetic rubber sector
DuPont Company	Wilmington, DE	11 129	27 516	282	
Eastman Chemical Company	Kingsport, TN	4 098	7 059	282	
Ecolab Inc.	Saint Paul, MN	2 327	4 535	284	Soap cleaner and toilet goods sector
International Flavors & Fragrances Inc.	New York, NY	572	1 993	286	Industrial organic chemicals
Johnson & Johnson	New Brunswick, NJ	28 400	50 434	283	Pharmaceutical preparations
Lilly (Eli) and Company	Indianapolis, IN	7 800	14 645	283	
Merck & Co., Inc.	Whitehouse Station, NJ	12 767	22 012	283	
Pfizer, Inc.	New York, NY	26 664	51 298	283	
Procter & Gamble Company	Cincinnati, OH	27 236	56 741	284	Soap cleaner and toilet goods sector
Rohm and Haas Company	Philadelphia, PA	4 216	7 994	282	Plastics materials, synthetic resins, and synthetic rubber sector

Table 1. Description of firms included in the analysis (2005)
[a] Sales in the US or in North America.

criteria: (1) they belonged to the Standard Industrial Classification code (SIC) 28 for chemical and allied products; (2) they had at least one facility reporting to the TRI in 2002; (3) they were publicly traded (and therefore have financial information publicly available) and (4) they were included in the KLD database (so we could compare our results with others). The cross-sectional analysis is conducted for the year 2005 and the trend analysis is from 2000 to 2005. We acknowledge that, although all these firms are from the same industrial sector, based on the two-digit SIC code, there are still substantial differences between the companies. As can be seen in Table 1, the firms analyzed in our study belong to the following main subsectors: cosmetics, pharmaceuticals, cleaning, organic chemicals and plastics. However, because our purpose is to demonstrate the trade-offs associated with sustainability rating, we needed to include companies with different attributes.

Description of Indicators

We focus on indicators that provide insights on the three main dimensions of environmental performance mentioned above: toxic releases, compliance with environmental regulations and beyond-compliance management practices. We use corporate sales in order to control for variation in size or output.[7]

The Toxic Release Inventory

The US EPA TRI publishes annual data on releases and transfers of toxic chemicals from US industrial facilities. This is a complex database that provides data on approximately 650 toxic chemicals (US EPA, Office of Pollution

[7] We use US or North American sales for 2005 since the environmental performance data is US based. Due to data availability, we use total sales for the period 2000–2005. The correlation between US and total sales in 2005 is high: 0.975(**).

DOI: 10.1002/bse

Prevention and Toxics). In this analysis, for the sake of simplicity, we compare firms based on their total pounds of toxic releases, which has been the indicator most used by scholars and screening organizations (Chatterji *et al.*, 2009; Gerde and Logsdon, 2001; Ilinitch *et al.*, 1998; King *et al.*, 2005).

Risk Screening Environmental Indicators (RSEIs)

One of the limitations of using total pounds from the TRI is that this measure does not provide information about the toxicity of the chemical and its potential impact on the population (Toffel and Marshall, 2004). Firms could emit small amounts of chemicals that are very toxic and be ranked better than firms with higher amounts of less-toxic chemicals. The RSEI software, developed by the US EPA and based on TRI data, computes the health risks associated with toxic releases (*RSEI Manual*, US EPA, 2004).[8]

Regulatory Compliance

The Enforcement and Compliance History Online (ECHO) database focuses on facility compliance with US environmental regulations.[9] We used the following information regarding regulatory compliance: quarters in non-compliance, informal enforcement actions and formal enforcement actions.

Reporting and Transparency

Reporting and transparency are often used by socially responsible investors as an input measure to complement environmental performance data. For example, KLD considers environmental communication as a *strength* and defines it as 'publishing substantive report, and having effective communication system to promote environmental best practices' (KLD website). SAM has a general environmental reporting section in its questionnaire explaining that industry experts review corporate environmental reports, but does not provide specific indicators to the public.[10]

In our analysis, we chose to use reporting and transparency indicators based on information available on the firm's website and environmental/social responsibility reports. The methodology used follows the analysis of the content of corporate annual reports and websites developed by Brammer and Pavelin (2006)[11], and consists of the aggregation of the following seven indicators to represent the quality of companies' corporate environmental disclosure (Belkaoui and Karpik; 1989; Brammer and Pavelin, 2006) (see Appendix B).

1. Does the firm publish an environmental or sustainability report?
2. If yes, is it according to the Global Reporting Initiative guidelines?[12]
3. Has the CEO/president signed the environmental policy?
4. Transparency and ease of obtaining information measured using the number of clicks from home page needed in order to read the environmental information or policy.
5. Does the firm have specific and clear goals and improvement targets?
6. Does the firm report actual performance numbers or just relative numbers?
7. Are the firm's reported numbers verified by a third party?

In addition, we use the environmental reporting score measurement of the Pacific Social Index developed by the Roberts Environmental Center (REC) at Claremont McKenna College.[13] The REC combines qualitative and

[8] RSEI considers the following information: the amount of chemical released, the location of this release, the toxicity of the chemical, its fate and transport through the environment, the route and extent of human exposure and the number of people affected (US EPA, 2004).
[9] Information provided in ECHO relates to facilities regulated under the Clean Air Act stationary sources, Clean Water Act permitted dischargers (under the National Pollutant Discharge Elimination System) and Resource Conservation and Recovery Act hazardous waste sites (ECHO website).
[10] SAM Research Corporate Sustainability Assessment Questionnaire. 2007. Mixed. http://www.sam-group.com [7 May 2007].
[11] The criteria used by Brammer and Pavelin (2006) include the disclosure of an environmental policy, the existence of board-level responsibility for environmental matters, the description of environmental initiatives, reporting on environmental improvements, the setting of environmental targets and the presence of an environmental audit or assessment. These criteria have been identified as indicators of best practices by the Global Reporting Initiative and the International Organization for Standardization.
[12] Global Reporting Initiative website. http://www.globalreporting.org/Home [1 May 2007].
[13] http://www.roberts.cmc.edu/PSI/whatthescoresmean.asp [1 March 2009].

DOI: 10.1002/bse

quantitative measurements to examine the quality of environmental reporting using measures similar to the ones we used in our analysis. These include the description of environmental issues and initiatives to address these issues, the existence of measurement metrics, explicit numerical goals and recognition from third parties.[14] The score is based on the percentage of issues that were covered and how well they were covered. We find that our disclosure scores are highly and significantly correlated with the REC reporting scores (0.76); this correlation provides assurance that our methodology is consistent with other disclosure measurements.[15]

Comparison of Toxic Releases, Compliance and Environmental Reporting

The rankings based on the four different indicators (TRI, RSEI, ECHO and reporting) are presented in Table 2. For each indicator, companies are ranked from 1 to 15. Consistent with most screening methodologies that classify companies in three or more categories, we group the companies into best, middle and worst performers, and illustrate these using different shades of gray.[16] White represents the best performance (rank 1–5), light gray represents the mid performance (rank 6–10) and dark gray represents the worst performance (rank 11–15).

When comparing the ranking of the companies using the different indicators, we observe some drastic differences. Five companies (Avon, Clorox, Dow, DuPont and Merck & Co.) had dissimilar rankings according to the

Firm	Rank based on TRI total release/ sales (lb/$)	Rank based on RSEI risk score/sales	ECHO (average non-compliance quarters/facility)	Reporting (7 criteria)	REC ER[2]	KLD total strengths	KLD total concerns
Avon Products, Inc.	1	1	6	12	N/A	8	1
Clorox Company	3	7	2	14	12	8	1
Colgate-Palmolive Company	2	6	5	7	5	8	1
Dial Corporation	N/A	N/A	1	7	14	N/A	N/A
Dow Chemical Company	13	12	15	2	3	1	14
DuPont Company	14	14	14	1	1	2	13
Eastman Chemical Company	11	13	12	12	9	8	7
Ecolab Inc.	4	5	7	3	11	2	1
International Flavors & Fragrances Inc.	9	4	3	14	13	8	1
Johnson & Johnson	5	2	9	3	8	2	6
Lilly (Eli) and Company	7	8	11	3	4	8	7
Merck & Co., Inc.	8	3	13	3	7	8	12
Pfizer, Inc.	12	9	10	7	6	2	11
Procter & Gamble Company	6	10	4	7	2	7	7
Rohm and Haas Company	10	11	8	7	10	6	7

Table 2. Rankings – comparison[1]

[1] Rank = 1 represents the best performer; rank = 15 represents the worst performer.

[2] Roberts Environmental Center (REC) environmental reporting scores (ER).

[14] Our seven-criterion ranking is based on additional criteria such as level of management involvement and the use of GRI guidelines.

[15] The results of the different evaluations of the environmental impacts and disclosure are reported in Appendices A and C.

[16] See for example Innovest Strategic Value Advisors http://www.csrwire.com/News/8820.html [1 March 2009].

DOI: 10.1002/bse

metrics chosen. Overall, 14 firms moved from one category (i.e. best, mid or worst performance) to another at least once. For example, Clorox ranked second for compliance but 14th for reporting. Even within the indicators representing toxic releases there were important differences. Six firms that were ranked in one category based on their TRI score were ranked in another category based on their RSEI score. The most striking difference, though, was between environmental performance and reporting indicators. Two firms that were ranked best based on the environmental reporting criteria were ranked worst on their toxic releases (Dow and DuPont). On the other hand, two firms that ranked best on TRI were ranked worst based on the reporting criteria (Avon and Clorox).

Our results show that some firms might have high environmental output in terms of toxic releases but excellent environmental reporting systems. We present correlations based on these different metrics in Tables 3 and 4. Table 3 presents correlations based on the year 2005 only while Table 4 presents the correlations for the period 2000–2005.[17]

As presented in Tables 3 and 4, there is a positive and significant correlation between the TRI and RSEI scores (>0.6). The correlation is also positive and significant between the compliance and TRI and RSEI scores (>0.7). This indicates that firms with higher toxic releases tend to also have lower compliance levels.

We also find that RSEI average trend data for the period 2000–2005 is not significantly correlated with RSEI 2005 data. This indicates that one year of data might not always be representative of previous and future years and points to the importance of using longitudinal analysis.

The seven-criterion reporting and CER environmental reporting scores are positively and significantly correlated with TRI, although they are not significantly related to the measure of TRI divided by sales. This might indicate that larger firms, with higher sales, are more likely to have the resources to conduct higher quality reporting. However, both reporting scores are positively and significantly correlated with lower levels of compliance per facility. The CER environmental reporting scores are all significantly and positively correlated with the compliance scores. This indicates that firms with lower compliance are performing better on the reporting and transparency scores. This might be explained by the fact that companies that are flagged as being in non-compliance are the ones that most need to show improvement in their reporting and compliance. These results illustrate the fact that it is possible for companies to perform well and poorly at the same time depending on the indicators chosen.

Comparison of Environmental Concerns Versus Environmental Strengths

We now compare our ranking with data from KLD. KLD selects companies for the Domini 400 index that have positive environmental, social and governance records. KLD evaluates companies in the context of their industry and sector as well as in relation to the broader market. Regarding the environment, KLD includes seven strengths (beneficial environmental products and services; pollution prevention activities; recycling activities; use of alternative fuels; environmental communication; above-average environmental performance for its property, plant and equipment and other strengths) and seven concerns (hazardous waste; regulatory problems; ozone-depleting chemicals; substantial emissions; agricultural chemicals; climate change and other concerns). Therefore, in the KLD data toxic releases are only one out of seven concerns.

When we analyze the KLD scores for the 1991–2005 period, we find that several of the companies with higher environmental concern scores also have higher environmental strength scores (Dow Chemical, Dupont, Merck, Pfizer, Rohm and Haas). For example Dow Chemical Company has the highest number of environmental strengths (28) but also a very high number of environmental concerns (69) (results provided in Appendix D).

As we can see in Table 3, there is a positive correlation between the KLD strengths and concerns for 2005 (0.494). The correlation becomes significant at the 1 percent level for the period 2000–2005 (see Table 4). This is consistent with previous research showing a high correlation between environmental strengths and concerns within KLD (Mattingly & Berman, 2006). When looking at the correlations of KLD strengths and concerns with other scores, we find that both strengths and concerns are positively correlated with TRI scores. The correlations are significant for environmental concerns, TRI, RSEI and ECHO scores for the year 2005. In addition, in the 2000–2005 period both environmental strengths and concerns are positively and significantly correlated with TRI and RSEI. However, the correlation is stronger (<0.75) for environmental concerns than for environmental strengths (<0.4). The KLD strengths are also positively and significantly correlated with our reporting scores

[17] The correlations are based on the actual numbers for each metric (i.e. pounds of toxic releases) and not the rankings.

DOI: 10.1002/bse

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 TRI total pounds 2005	1													
2 TRI total pounds/total sales 2005	0.938(**)	1												
3 TRI total pounds/US sales 2005	0.903(**)	0.982(**)	1											
4 RSEI risk score 2005	0.776(**)	0.802(**)	0.749(**)	1										
5 RSEI risk score/total sales 2005	0.657(*)	0.767(**)	0.719(**)	0.952(**)	1									
6 RSEI risk score/US sales 2005	0.644(*)	0.758(**)	0.727(**)	0.947(**)	0.987(**)	1								
7 Ave. noncompliance Q/facility 2005–2008	0.837(**)	0.780(**)	0.692(**)	0.574(*)	0.481	0.437	1							
8 Ave. formal actions 2003–2008/facility	0.763(**)	0.812(**)	0.755(**)	0.810(**)	0.759(**)	0.713(**)	0.771(**)	1						
9 Ave. informal actions 2003–2008/facility	0.780(**)	0.848(**)	0.795(**)	0.771(**)	0.725(**)	0.707(**)	0.753(**)	0.792(**)	1					
10 Reporting score (score based on all 7 criteria) 2007	0.624(*)	0.448	0.381	0.381	0.250	0.239	0.686(**)	0.443	0.327	1				
11 PSI env. reporting score 2006	0.714(**)	0.478	0.423	0.275	0.060	0.044	0.761(**)	0.499	0.480	0.601(*)	1			
12 RSEI trend 2000–2005	0.411	0.363	0.385	0.495	0.433	0.530	0.165	0.090	0.278	0.228	0.231	1		
13 KLD total No concerns 2005	0.961(**)	0.881(**)	0.831(**)	0.799(**)	0.649(*)	0.631(*)	0.840(**)	0.802(**)	0.815(**)	0.630(*)	0.730(**)	0.342	1	
14 KLD total No strengths 2005	0.478	0.435	0.471	0.399	0.345	0.345	0.425	0.509	0.155	0.644(*)	0.332	0.033	0.494	1

Table 3. Correlations

DOI: 10.1002/bse

1		1	2	3	4	5	6
1	TRI_TP TRI total pounds (2000–2005)	1					
2	TRI_Size TRI total pounds/total sales (2000–2005)	0.922**	1				
3	RSEI_score RSEI risk score (2000–2005)	0.737**	0.728**	1			
4	RSEI_size RSEI risk score/total sales (2000–2005)	0.650**	0.734**	0.957**	1		
5	KLD_Concerns total no. of concerns (2000–2005)	0.869**	0.816**	0.748**	0.683**	1	
6	KLD_Strengths total no. of strengths (2000–2005)	0.381**	0.289**	0.468**	0.401**	0.413**	1

Table 4. Correlations
* Spearman correlations reported. Correlation is significant at the 0.05 level (two tailed). ** Correlation is significant at the 0.01 level (two tailed).

(0.644). In summary, firms that are better at reporting and have the most advanced environmental management practices are also those with higher levels of toxic releases and lower environmental compliance. Again, this illustrates the trade-offs that investors face when using a limited set of indicators. If they focus exclusively on environmental management practices, they might miss firms' current environmental impact.

We recognize that our analysis is not without limitations. TRI provides facility information only for facilities located in the United States that emit above a specific threshold. It excludes small facilities. The information on toxic releases and compliance is therefore US based, while most of the companies studied operate internationally. The reporting rankings are based on the firms' reports for 2005 and access to their websites in May 2007. This means that we compared data from different years for different indicators.

Discussion

Our findings show that the same firms can perform both well and poorly on indicators used in sustainable ratings. These findings mean that investors face trade-offs when choosing their screening methodology (positive or negative screening), when choosing indicators and when assigning weights to these indicators. Based on this discussion and the findings of our rating case study, we provide below some principles that can help manage some of the trade-offs associated with sustainable rating.

Positive or Negative Screening?

We mentioned that the 'best in class' approach runs the risk of including companies that might be the worst performers on some dimensions. Indeed, focusing only on 'strengths' would mean including companies that may also have high concerns. This is because environmental strengths and environmental concerns are positively correlated. It is therefore imperative to combine both positive and negative indicators. One simple way to conduct the analysis is to follow the method of Kempf and Osthoff (2007), who transformed KLD concerns into strengths by taking the binary complements. This way, concerns and strengths are aggregated and have the same weights. However, the weights to assign to positive and negative indicators need to be aligned with each rater's main objectives regarding their preferences for environmental criteria and how these relate to financial performance. Another approach could be to use the Data Envelopment Analysis methodology, in which multiple indicators on a different scale can all be factored into one efficiency relative score (Kuosmanen and Kortelainen, 2005; Chen and Delmas, 2009; Chen *et al.*, 2009).

Assigning Weights to Environmental Performance Indicators

When using a multi-criterion methodology, the weight assignments should be clear. Although we did not illustrate this with our data, it is worth noting that the weight of an indicator in a rating scheme is the result of the combination of both the weighting attributed to the indicator and of the scale that is used to measure the indicator. It

DOI: 10.1002/bse

is therefore important that the scales measuring the indicators be similar. In addition, it is possible that not all the rating schemes use simple linear scoring. That is to say, criteria might not all be totally independent from each other. Because of this, raters should be clear on the criteria and the weighting schemes, as well as the scales used.

The reasoning for using specific indicators and for assigning higher weights to specific indicators must be based on explicit priorities whenever possible.[18] For example, grassroots organizations can argue that the actual impact of the companies on the local environment is more important than the reporting of their impact, and therefore assign higher weight to RSEI and ECHO indicators than to reporting indicators. Because the weight assignment is somewhat subjective, it should be carefully explained. One possible way to provide a better scientific basis for assigning weights is to survey stakeholders' preferences for specific environmental impacts. For example, contingent valuation surveys could be used to assess these preferences.

Other methodologies that have been used for life cycle assessment could also be useful (Powel *et al.*, 1997). For example, emissions can be weighted based on legal limits and aggregated within each environmental medium (air, water, soil). Valuation can also be based on ecological scarcities. In that case the valuation is based on emission flows and resources relative to the ability of the environment to assimilate the flows or the extent of resources available.

Choosing Indicators Wisely

Because quantitative data on corporate environmental performance is seldom publicly available, the risk is to choose variables based on their availability. If investors rely only on one set of data (environmental reporting or toxic releases, for example), they might get an inaccurate picture of the performance of corporations. This is because, as we illustrated, strengths on some criteria might be correlated with weaknesses on others. This demonstrates the need for multi-criterion indicators and sometimes for detailed data that is not always publicly available. The three categories of indicators that we described (environmental impact, regulatory compliance, and management systems and reporting) should be included, as they represent different facets of firm compliance. One example of management practice indicators can be found in the work of Delmas and Toffel (2008a, 2008b). The indicators used by Delmas and Toffel include, for instance, the extent of in-firm training related to corporate environmental performance, and the use of environmental performance in employee job-performance reviews.

Choosing the Appropriate Comparison Group

When comparing companies, the sample group should be carefully considered. It is important to make sure that the companies are comparable and that there is data available for all of them. Since companies vary in the nature of their operations, comparing companies from different industries might not be appropriate. In our case study we included companies from the chemical industry (SIC Code 28). However, the companies included came from different sub-sectors of the chemical industry. For example, Colgate-Palmolive is from the soap, cleaner and toilet goods sector (SIC 284), while Dow Chemical Company is from the plastics, materials, synthetic resins and synthetic rubber sector (SIC 282). In our sample, the average TRI releases in pounds per unit of sale is 1.8 lb/$ for SIC 284 against 12.25 lb/$ for SIC 282 (see Appendix A). Differences in the amount of toxic chemicals produced might be a function of differences in production processes. If investors seek to keep the less polluting companies within a broad range of sectors, screening out the biggest polluters might be equivalent to screening out some entire sectors.

Favoring a Longitudinal Approach

If the ranking aims at forecasting long-term performance, it should combine indicators that are based on multi-year data. Improvement in environmental performance is a long process. It might take a few years before changes can be implemented. Looking at trends provides insights into companies' commitment to improvement of their environmental performance. RSEI data is a perfect example of multi-year data that is publicly available and appropriate for use when evaluating companies. As we showed, looking at static data for a specific year for all companies is also valuable; however, it is problematic in the case where a firm had a one-time incident that year or when data

[18] Note that not assigning weights is equivalent to assigning equal weights to the various metrics used.

DOI: 10.1002/bse

is not available for the same year for all companies. Our analysis showed no significant correlation between a trend variable representing 5 years of data for RSEI and the data for the year 2005. A combination of indicators that are based on both single- and multi-year data is more comprehensive and robust.

In conclusion, if rating reduces information asymmetry between what corporations know about environmental performance and what investors want to know, we need to better understand what goes into the rating. Transparency about screening methodologies will facilitate methodological improvements. By comparing and evaluating transparent sustainability ratings, stakeholders can help improve the quality of these ratings. We propose the following recommendations to increase the credibility of sustainability ratings.

- Be clear about the goal of the evaluation.
- Be transparent on the criteria used.
- Use both negative and positive screening.
- Use a methodology that reflects both real environmental impact and management practices.
- Be specific on the comparison group.
- Favor a longitudinal approach.

Conclusion

In this paper, we ranked 15 companies using three sets of indicators; the results demonstrate the challenges associated with screening companies based on their environmental performance.

The main findings of our analysis of the environmental performance of 15 chemical companies is that firms with lower environmental performance and compliance tend to provide better quality of environmental reporting and to adopt more pollution prevention activities. Ratings that favor companies with better environmental management practices might therefore also reward companies with current lower environmental and compliance performance. The results of the ranking based on three main categories of indicators (impact, compliance and management) clearly demonstrate the drawbacks of using only one type of indicator either because of data availability or because of investors' preferences. The same is true when using only positive or negative indicators.

Because there are many choices that need to be made when choosing a metric, and because these choices have a significant impact on the final rating, we pointed out the importance of being transparent about these choices. Sustainability rating methodologies are still in their early phases of development and are often contentious. Because there are so many ways to evaluate firms' environmental performance and because of the current lack of standards in this area, there is the risk that investors might lose confidence in the approach. Transparency will increase the credibility of sustainability ratings and will also facilitate the standardization and potential diffusion of these ratings. Although we focused on corporate environmental performance, similar issues would be raised for the measurement of social performance.

However, there are limits to how transparent rating organizations can be. Because there is still very limited publicly available information on corporate environmental performance, rating organizations invest in costly research about environmental management practices and performance. They must keep this information proprietary in order to sell it to investors. Furthermore, each of these rating organizations develops proprietary rating methodology, which is the basis of their competitive advantage in the rating market. Transparency about their methodology would mean that they could be easily imitated by their competitors and that they could lose their competitive edge. Further research could investigate how sustainability rating standards could be established to harmonize the different existing systems, while maintaining the incentives for sustainability rating companies to invest in research.

Transparency is key and well established within the financial reporting scheme. Lowenstein (1996) argues that the openness about the way firms operate in the United States makes the American industry more efficient and competitive. If this is correct for environmental performance as well, then once reporting and measuring environmental performance become more common some standardization and 'rules' for transparency will be needed. However, this will only be feasible if information about corporate environmental performance becomes publicly available, as is financial information.

DOI: 10.1002/bse

References

Belkaoui A, Karpik PG. 1989. Determinants of the corporate decision to disclose social information. *Accounting, Auditing, and Accountability Journal* **2**(1): 36–51.

Brammer S, Pavelin S. 2006. Voluntary environmental disclosures by large UK companies. *Journal of Business Finance and Accounting* **33**(7/8): 1168–1188. DOI: 10.1111/j.1468-5957.2006.00598.x

Chatterji AK, Levine DI. 2008. *Imitate or Differentiate? Evaluating the Validity of Corporate Social Responsibility Ratings*, Center for Responsible Business, University of California Berkeley, Working Paper Series, Paper 37. http://repositories.cdlib.org/crb/wps/37 [17 September 2008].

Chatterji AK, Levine DI, Toffel MW. 2009. How well do social ratings actually measure corporate social responsibility? *Journal of Economics and Management Strategy* **18**(1): 125–169.

Chen C-M, Delmas M. 2009. *Measuring Corporate Social Responsibility: an Efficiency Perspective*, working paper. UCLA Institute of the Environment: Los Angeles, CA.

Chen C-M, Delmas MA, Montes-Sancho M. 2009. *Eco- Vs. Productive Efficiency: a New Approach to Effective and Comparative Performance Analysis*, working paper. UCLA Institute of the Environment: Los Angeles, CA.

Christmann P. 2000. Effects of 'best practices' of environmental management on cost advantage: the role of complementary assets. *Academy of Management Journal* **43**(4): 663–680.

Delmas M, Montiel I. 2008. The diffusion of voluntary international management standards: Responsible Care, ISO 9000 and ISO 14001 in the chemical industry. *Policy Studies Journal* **36**(1): 65–93.

Delmas MA, Toffel MW. 2008a. Organizational responses to environmental demands: opening the black box. *Strategic Management Journal* **29**(10): 1027–1055.

Delmas M, Toffel M. 2008b. *Survey Questionnaire on Environmental Management Practices: Summary of Results by Industry and Practices*. University of California: Santa Barbara, CA.

Dowell G, Hart S, Yeung, B. 2000. Do corporate global environmental standards create or destroy market value? *Management Science* **46**(8): 1059–1074.

Gerde VW, Logsdon JM. 2001. Measuring environmental performance: use of the Toxics Release Inventory (TRI) and other US environmental databases. *Business Strategy and the Environment* **10**(5): 269–285.

Griffin J, Mahon J, 1997. The corporate social performance and corporate financial performance debate: twenty-five years of incomparable research. *Business and Society* **36**(1): 5–31.

Hoffman AJ. 1999. Institutional evolution and change: environmentalism and the US chemical industry. *Academy of Management Journal* **42**(4): 351–371.

Ilinitch AY, Soderstrom NS, Thomas TE. 1998. Measuring corporate environmental performance. *Journal of Accounting and Public Policy* **17**: 383–408.

Kempf A, Osthoff P. 2007. The effect of socially responsible investing on portfolio performance. *European Financial Management* **13**(5): 908–922.

King A, Lenox M. 2001. Lean and green? An empirical examination of the relationship between lean production and environmental performance. *Production and Operations Management* **10**(3): 244–257.

King A, Lennox M, Terlaak A. 2005. The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal* **48**: 1091–1106.

Klassen R, McLaughlin C. 1996. The impact of environmental management on firm performance. *Management Science* **42**: 1199–1214.

Konar S, Cohen RA. 2001. Does the market value environmental performance? *Review of Economics and Statistics* **83**(2): 281–289.

Kuosmanen T, Kortelainen M. 2005. Measuring eco-efficiency of production with data envelopment analysis. *Journal of Industrial Ecology* **9**(4): 59–72.

Levine DI, Chatterji AK. 2006. Breaking down the wall of codes: evaluating non-financial performance measurement. *California Management Review* **48**(2): 29–51.

Lober D. 1996. Evaluating the environmental performance of corporations. *The Journal of Managerial Issues* **8**(2): 184–205.

Lowenstein L. 1996. Financial transparency and corporate governance: you manage what you measure. *Columbia Law Review* **96**(5): 1335–1362.

Margolis JD, Walsh JP. 2003. Misery loves companies: rethinking social initiatives by business. *Administrative Science Quarterly* **48**(2): 268.

Mattingly JE, Berman SL. 2006. Measurement of corporate social action, discovering taxonomy in KLD ratings data. *Business and Society* **45**(1): 20–46.

Orlitzky M, Schmidt FL, Rynes SL. 2003. Corporate social and financial performance: a meta-analysis. *Organization Studies* **24**(3): 403–441.

O'Rourke A. 2003. The message and methods of ethical investment. *Journal Of Cleaner Production* **11**(6): 683–693.

Porter ME, Van der Linde C. 1995. Toward a new conception of the environment–competitiveness relationship. *The Journal of Economic Perspectives* **9**(4): 97–118.

Powel JC, Pearce DW, Craighill AL. 1997. Approaches to valuation in LCA impact assessment. *The International Journal of Life Cycle Assessment* **2**(1): 11–15.

Reinhardt F. 1999. Market failure and the environmental policies of firms. *Journal of Industrial Ecology* **3**(1): 9–21.

Renneboog L, Ter Horst J, Zhang C. 2008. Socially responsible investments: institutional aspects, performance, and investor behavior. *Journal of Banking and Finance* **32**: 1723–1742.

Russo MV, Fouts PA. 1997. A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal* **40**(3): 534–559.
Social Investment Forum. 2007. *Report on Socially Responsible Investing Trends in the United States*. Washington, DC. http://www.socialinvest.org/resources/pubs/documents/FINALExecSummary_2007_SIF_Trends_wlinks.pdf
Terlaak A, King A. 2006. The effect of certification with the ISO 9000 quality management standard: a signaling approach. *Journal of Economic Behavior and Organization* **60**(4): 579–602.
Toffel MW, Marshall JD. 2004. Improving environmental performance assessment: comparative analysis of weighting methods used to evaluate chemical release inventories. *Journal of Industrial Ecology* **8**(1/2): 143–172.
US EPA, Office of Pollution Prevention and Toxics. Toxic Release Inventory website. http://www.epa.gov/tri/ [1 May 2007].
US EPA. 2004. *User's Manual for RSEI Version 2.1.2*. http://www.epa.gov/opptintr/rsei/pubs/users_manual_aug2004.pdf [21 July 2007].
US EPA. Enforcement and Compliance History Online website. http://www.epa.gov/echo/ [1 May 2007].
Waddock SA, Graves SB. 1997. The corporate social performance–financial performance link. *Strategic Management Journal* **18**(4): 303–319.
Wood D. 1991. Corporate social performance revisited. *Academy of Management Review* **16**(4): 691–718.

Appendix A. Ranking-Based Toxic Releases, Risk Screening Environmental Indicators and ECHO (US EPA)[a]

Firm	Rank based on TRI total release 2005/ sales (lb/$)	TRI total release 2005/sales (lb/$)	Rank based on RSEI risk score 2005/ sales	RSEI risk score 2005/ sales	ECHO (average non-compliance quarters/facility) 2005–2008
Avon Products, Inc.	1	0.00	1	0.00	6
Clorox Company	3	5.36	7	0.21	2
Colgate-Palmolive Company	2	1.90	6	0.10	5
Dial Corporation	N/A	N/A	N/A	N/A	1
Dow Chemical Company	13	4 250.86	12	9.54	15
DuPont Company	14	11 018.96	14	27.52	14
Eastman Chemical Company	11	2 372.34	13	25.65	12
Ecolab Inc.	4	55.98	5	0.081	7
International Flavors & Fragrances Inc.	9	1 433.93	4	0.033	3
Johnson & Johnson	5	96.95	2	0.003	9
Lilly (Eli) and Company	7	1 366.01	8	0.508	11
Merck & Co., Inc.	8	1 430.23	3	0.029	13
Pfizer, Inc.	12	2 515.47	9	0.957	10
Procter & Gamble Company	6	2 188.86	10	1.500	4
Rohm and Haas Company	10	3 255.24	11	5.403	8

[a] Rank = 1 represents the best performer; rank = 14 represents the worst performer.

DOI: 10.1002/bse

Appendix B. Environmental Reporting Indicators[a] [b]

	Environmental report? (Y or N)	Report to GRI standards*? (Y or N)	Number of clicks to environmental info. (2 or less)	Existence of performance targets	Level of commitment (who sign policy)	Reporting 'hard' numbers	Third party verification/ auditing	7-criterion score summary
Avon Products, Inc.	0	0	1	1	1	0	1	4.0
Clorox Company	0	0	1	0	0	0	0	1.0
Colgate-Palmolive Company	1	0	1	0	1	1	1	5.0
Dial Corporation	1	1	1	0	1	1	0	5.0
Dow Chemical Company	1	1	1	1	1	1	0.5	6.5
DuPont Company	1	1	1	1	1	1	1	7.0
Eastman Chemical Company	1	0		1	0	1	1	4.0
Ecolab Inc.	1	1	1	0	1	1	1	6.0
International Flavors & Fragrances Inc.	0	0	0	0	1	0	0	1.0
Johnson & Johnson	1	1	1	1	1	1	0	6.0
Lilly (Eli) and Company	1	1	1	1	1	1	0	6.0
Merck & Co., Inc.	1	1	1	1	1	1	0	6.0
Pfizer, Inc.	1	0	1	1	1	1	0	5.0
Procter & Gamble Company	1	1	0	1	1	1	0	5.0
Rohm and Haas Company	1	0	1	0	1	1	1	5.0

[a] 1 = yes, 0 = no; data was collected for the year of 2005, but in a few cases we used data for 2003, 2004 or 2006.

[b] Avon website, http://www.avon.com [1 May 2007]; Clorox website, http://www.clorox.com/ [27 April 2007]; Colgate website, http://www.colgate.com [3 May 2007]; DuPont website, http://www.dupont.com [1 May 2007]; Eastman Chemical website, http://www.eastman.com [1 May 2007]; Ecolab Inc. website, http://www.ecolab.com [2 May 2007]; Eli Lilly website, http://www.lilly.com [2 May 2007]; Henkel website, http://www.henkel.com; International Flavors & Fragrances website, http://www.iff.com [2 May 2007]; Johnson & Johnson website, http://www.jnj.com [2 May 2007]; Merck website, http://www.merck.com [2 May 2007]; Pfizer website, http://www.pfizer.com [2 May 2007]; Procter & Gamble website, http://www.pg.com [2 May 2007]; Rohm & Haas website, http://www.rohmhaas.com [2 May 2007].

*Based on GRI Registry database.

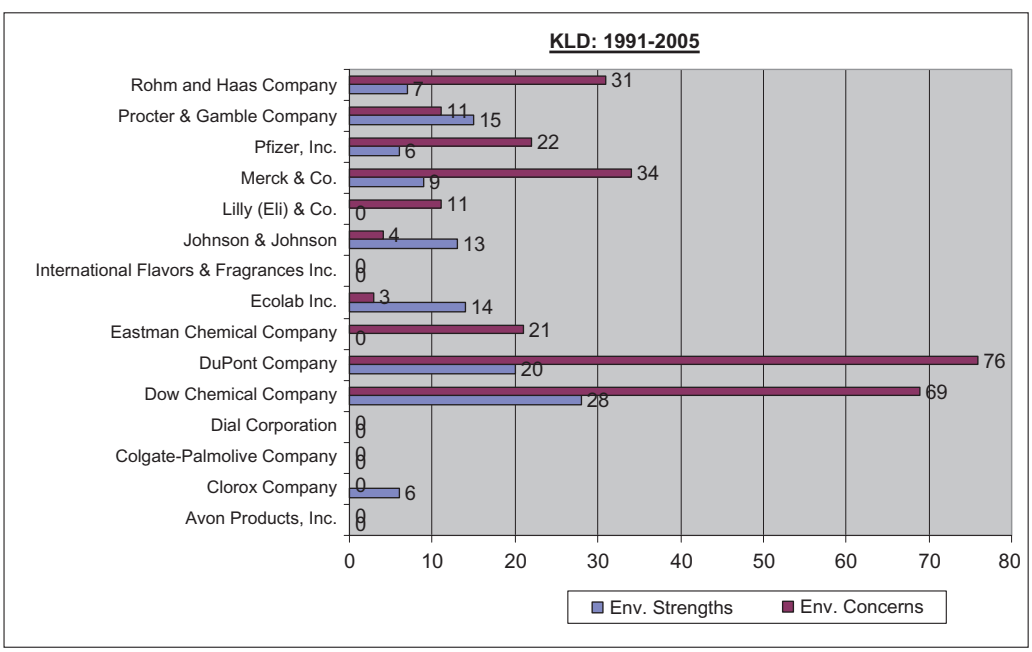
DOI: 10.1002/bse

Appendix C. Environmental Information Disclosure Scores and Rankings: Seven-Criterion Score, Roberts Environmental Center (REC) Environmental Reporting Scores (ER) and Carbon Disclosure Project (CDP)[a]

	7-criterion score	Rank 7-criterion score	REC ER	Rank REC ER	CDP 2006 participation	CDP 2006 leadership scores	Rank CDP 2006
Avon Products, Inc.	4.0	12	N/A	N/A	0	–	–
Clorox Company	1.0	14	2	12	0	–	–
Colgate-Palmolive Company	5.0	7	48	5	1	50	7
Dial Corporation (The)	5.0	7	0	14	0	–	–
Dow Chemical Company	6.5	2	62	3	1	85	2
DuPont Company	7.0	1	66	1	0	–	–
Eastman Chemical Company	4.0	12	34	9	0	–	–
Ecolab Inc.	6.0	3	17	11	0	–	–
International Flavors & Fragrances Inc.	1.0	14	1	13	0	–	–
Johnson & Johnson	6.0	3	35	8	1	75	3
Lilly (Eli) and Company	6.0	3	53	4	1	60	5
Merck & Co., Inc.	6.0	3	42	7	1	65	4
Pfizer, Inc.	5.0	7	44	6	1	90	1
Procter & Gamble Company	5.0	7	65	2	1	55	6
Rohm and Haas Company	5.0	7	27	10	0	–	–

[a] Rank = 1 represents the best performer; rank = 14 represents the worst performer.

Appendix D. KLD 1991–2005



DOI: 10.1002/bse